Network Systems Science & Advanced Computing

Biocomplexity Institute & Initiative

University of Virginia

Integrated Biosurveillance of COVID-19 in Virginia

March 9th, 2023

(data current to February 23rd – March 9th)

Biocomplexity Institute Technical report: TR BI-2023-24

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biocomplexity.virginia.edu

About Us

- Biocomplexity Institute at the University of Virginia
  - Using big data and simulations to understand massively interactive systems and solve societal problems
- Over 20 years of crafting and analyzing infectious disease models
  - Pandemic response for Influenza, Ebola, Zika, and others

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Overview

- **Goal**: Understand, evaluate, and develop COVID-19 indicators from the wide variety of existing indicators for Virginia
- **Approach:**
  - Monitor existing indicators
  - Study new data sources and combinations of existing sources
- **Outcomes:**
  - New indicators and metrics for measuring disease in the Commonwealth of Virginia

Key Takeaways

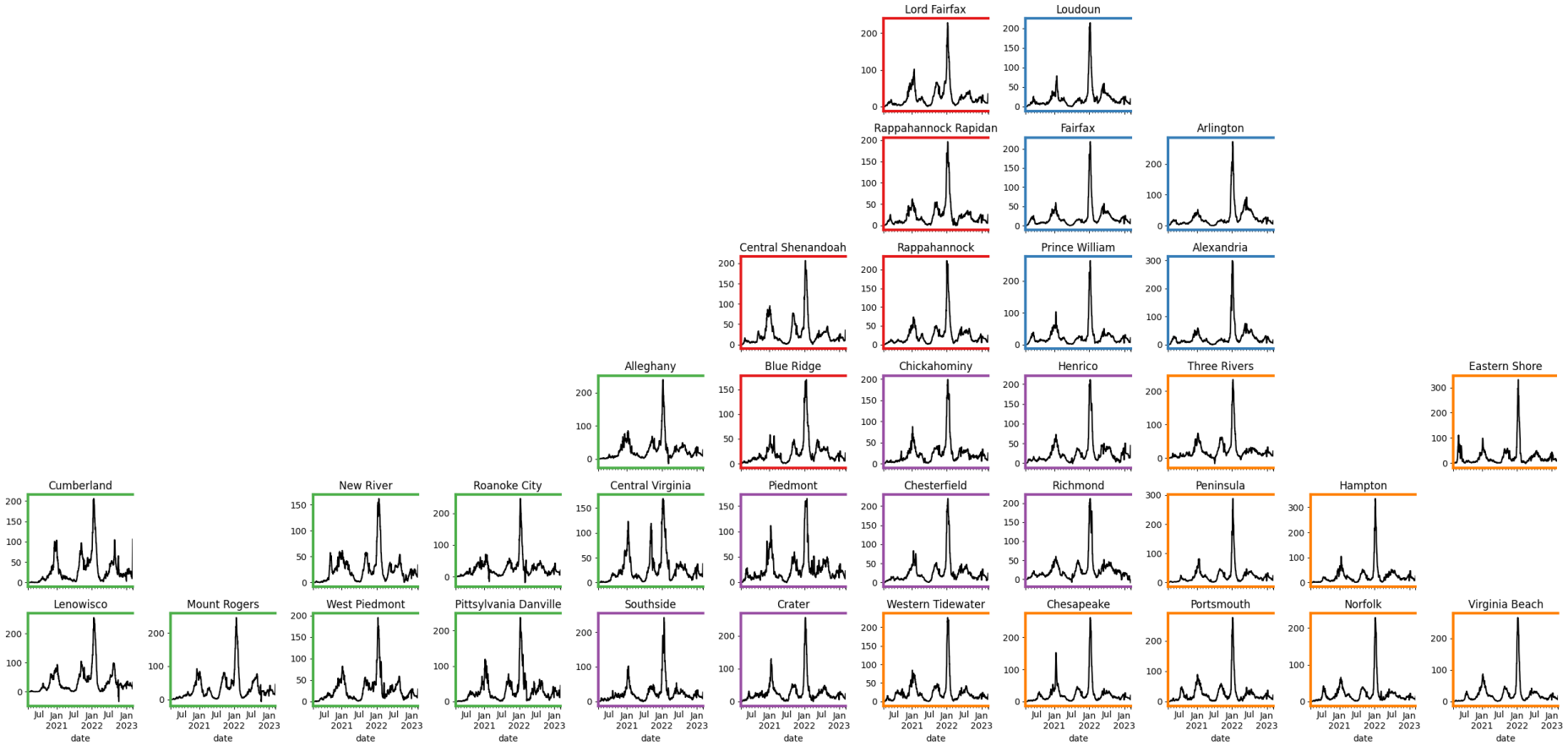
Declines continue in COVID-19 cases and hospitalizations and most other indicators

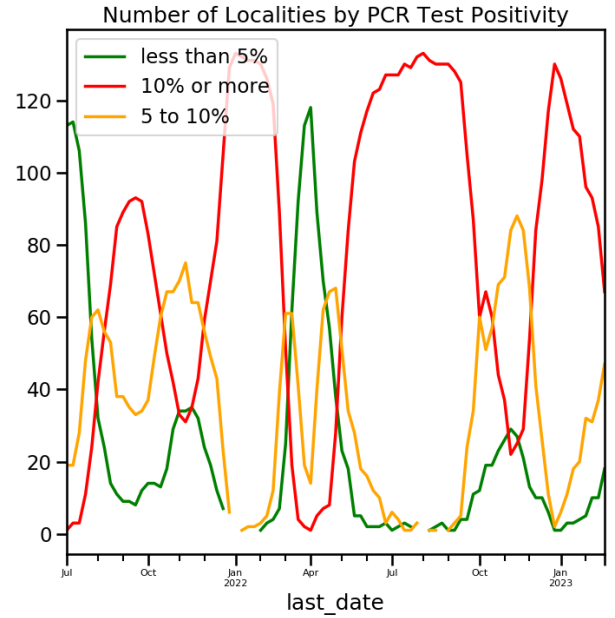
- COVID-19 Growth indicators are consistent with this trend continuing
- COVID-19 Severity indicators remain steady
    - Declines felt across all age-groups

The situation continues to change. Models continue to be updated regularly.

COVID-19 Surveillance

Case Rates (per 100k) and Test Positivity





County level RT-PCR test positivity

Green: <5.0% (or <20 tests in past 14 days)

Orange: 5.0%-10.0% (or <500 tests and <2000 tests/100k and >10% positivity over 14 days)

Red: >10.0% (and not "Green" or "Yellow")

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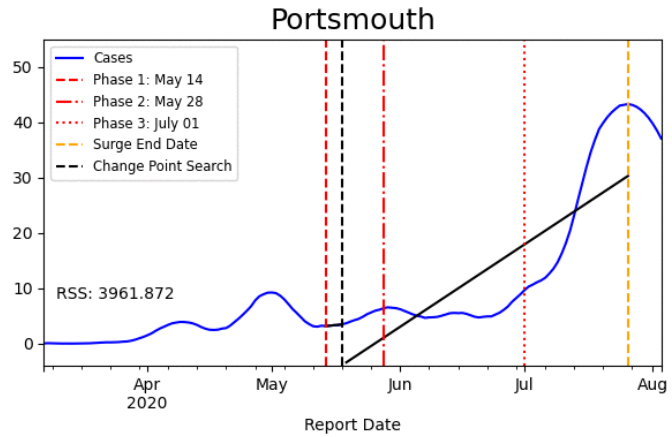
District Trajectories

Goal: Define epochs of a Health District's COVID-19 incidence to characterize the current trajectory

Method: Find recent peak and use hockey stick fit to find inflection point afterwards, then use this period's slope to define the trajectory

Hockey stick fit

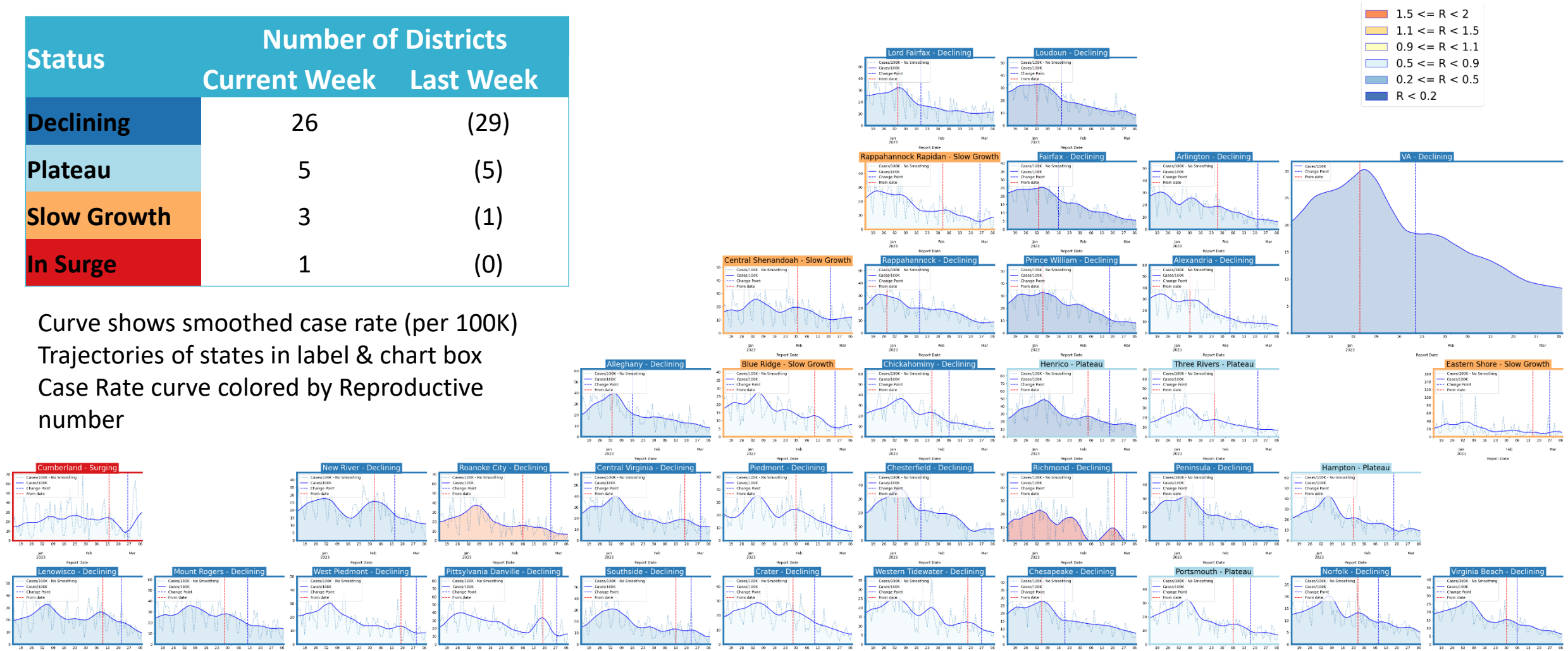


Trajectory	Description	Weekly Case Rate Slope (per 100k)	Weekly Hosp Rate Slope (per 100k)
Declining	Sustained decreases following a recent peak	slope < -0.88/day	slope < -0.07/day
Plateau	Steady level with minimal trend up or down	-0.88/day < slope < 0.42/day	-0.07/day < slope < 0.07/day
Slow Growth	Sustained growth not rapid enough to be considered a Surge	0.42/day < slope < 2.45/day	0.07/day < slope < 0.21/day
In Surge	Currently experiencing sustained rapid and significant growth	2.45/day < slope	0.21/day < slope

District Case Trajectories – last 10 weeks

Status	Number of Districts	
	Current Week	Last Week
Declining	26	(29)
Plateau	5	(5)
Slow Growth	3	(1)
In Surge	1	(0)

Curve shows smoothed case rate (per 100K)
Trajectories of states in label & chart box
Case Rate curve colored by Reproductive number



District Hospital Trajectories – last 10 weeks

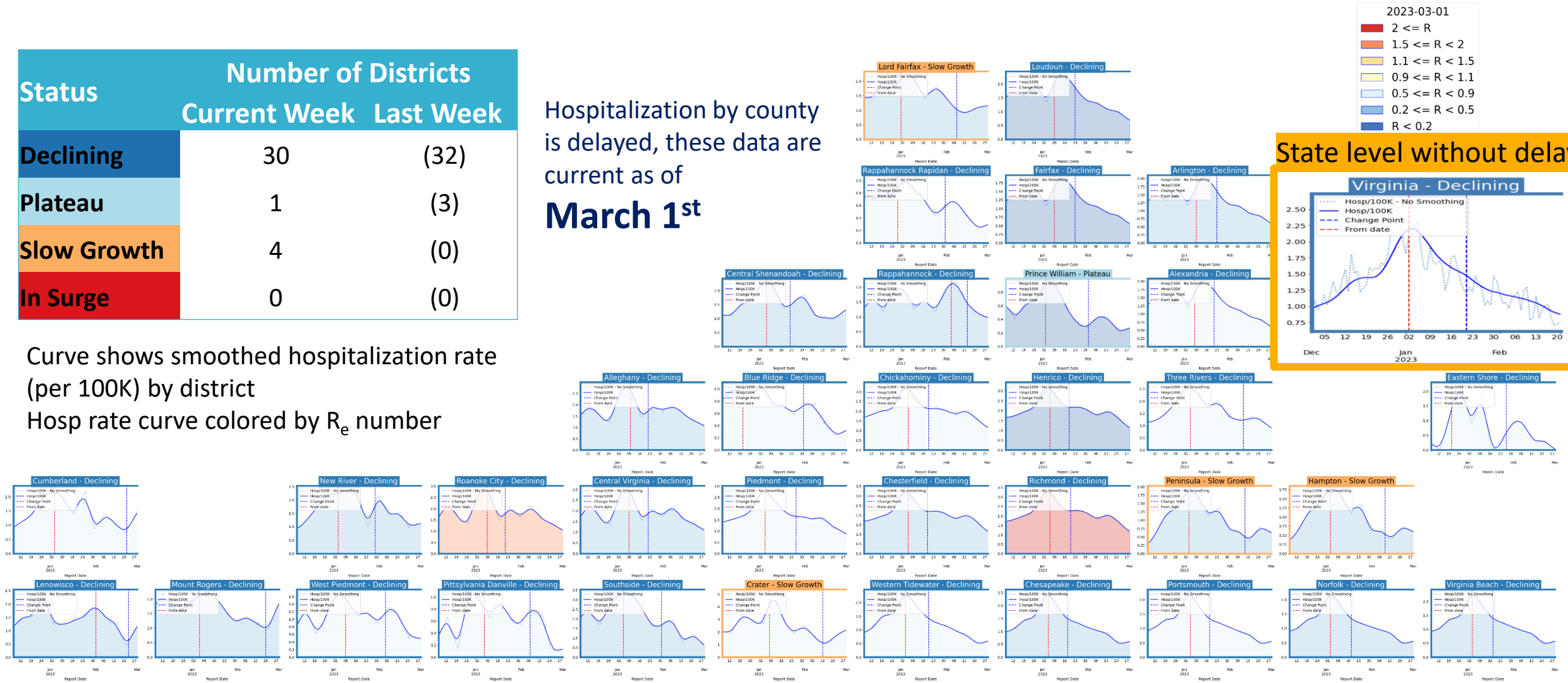
Status	Number of Districts	
	Current Week	Last Week
Declining	30	(32)
Plateau	1	(3)
Slow Growth	4	(0)
In Surge	0	(0)

Hospitalization by county is delayed, these data are current as of

March 1st

Curve shows smoothed hospitalization rate (per 100K) by district

Hosp rate curve colored by R_e number



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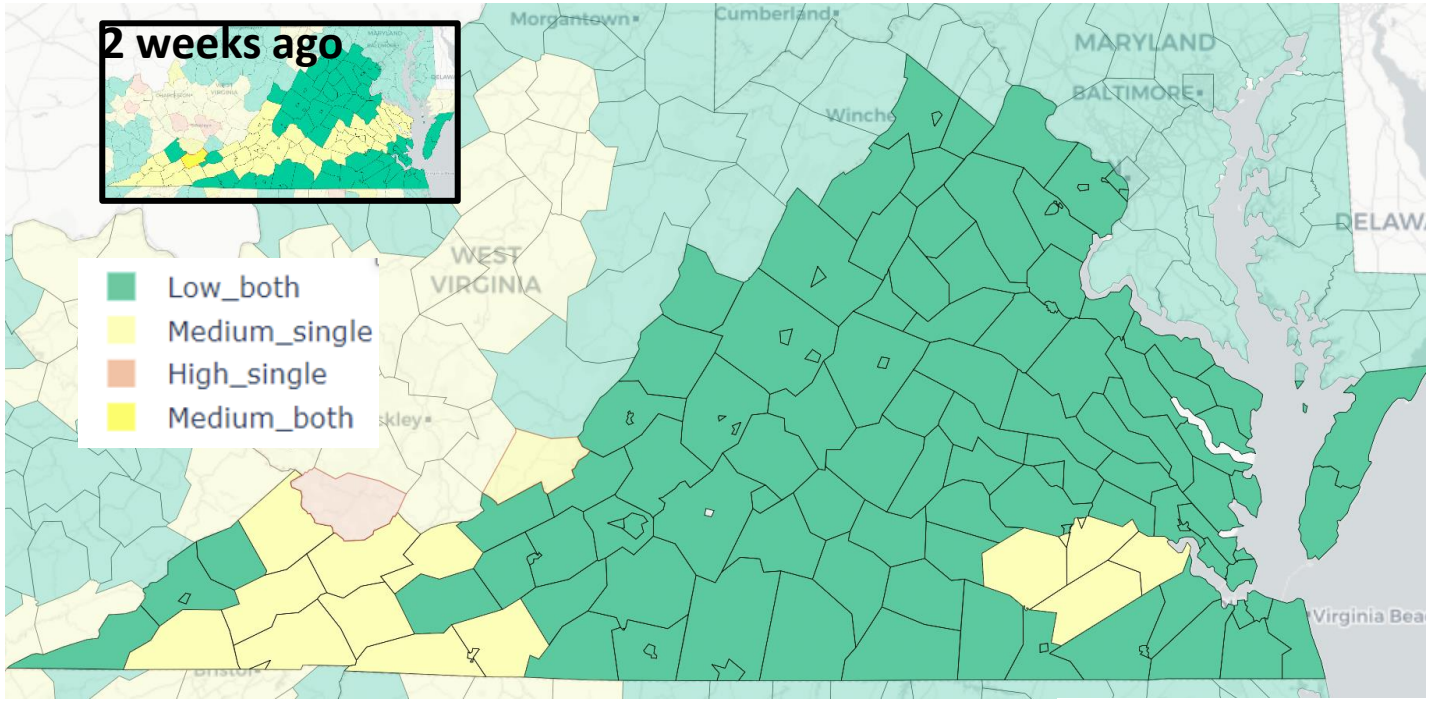
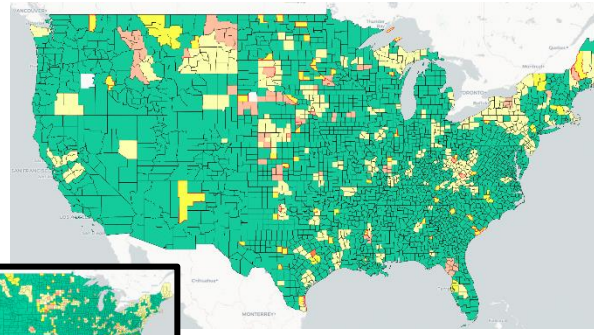
CDC's COVID-19 Community Levels

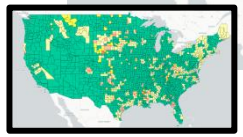


Red outline indicates county had 200 or more cases per 100k in last week

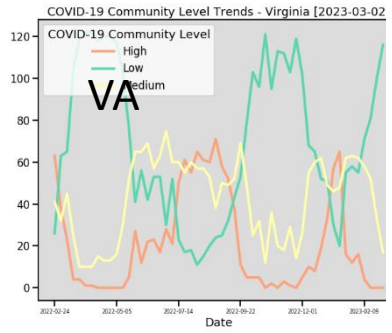
Pale color indicates either beds or occupancy set the level for this county

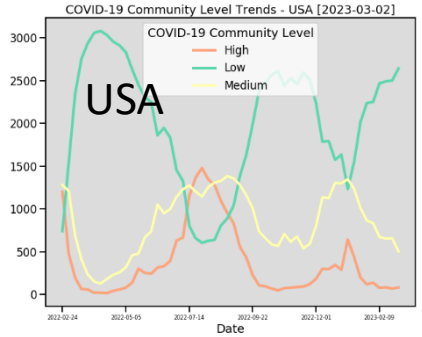
Dark color indicates both beds and occupancy set the level for this county





2 weeks ago





As of Mar 3rd, 2023

COVID-19 Community Levels – Use the Highest Level that Applies to Your Community

New COVID-19 Cases Per 100,000 people in the past 7 days	Indicators	Low	Medium	High
Fewer than 200	New COVID-19 admissions per 100,000 population (7-day total)	<10.0	10.0-19.9	≥20.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	<10.0%	10.0-14.9%	≥15.0%
200 or more	New COVID-19 admissions per 100,000 population (7-day total)	NA	<10.0	≥10.0
	Percent of staffed inpatient beds occupied by COVID-19 patients (7-day average)	NA	<10.0%	≥10.0%

The COVID-19 community level is determined by the higher of the new admissions and inpatient beds metrics, based on the current level of new cases per 100,000 population in the past 7 days

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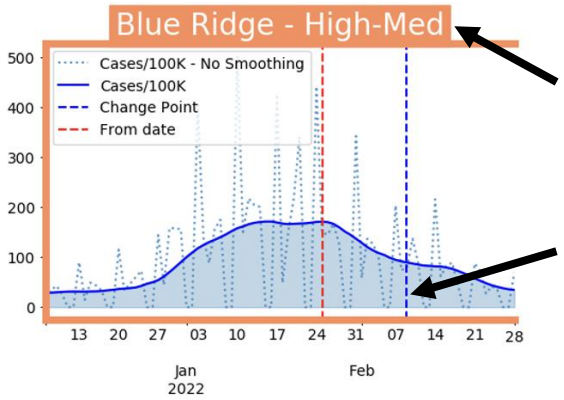
Data from: CDC Data Tracker Portal

District Trajectories with Community Levels

Community Level (Title Color)
- High
- High-Med
- Med-High
- Medium
- Med-Low
- Low-Med
- Low

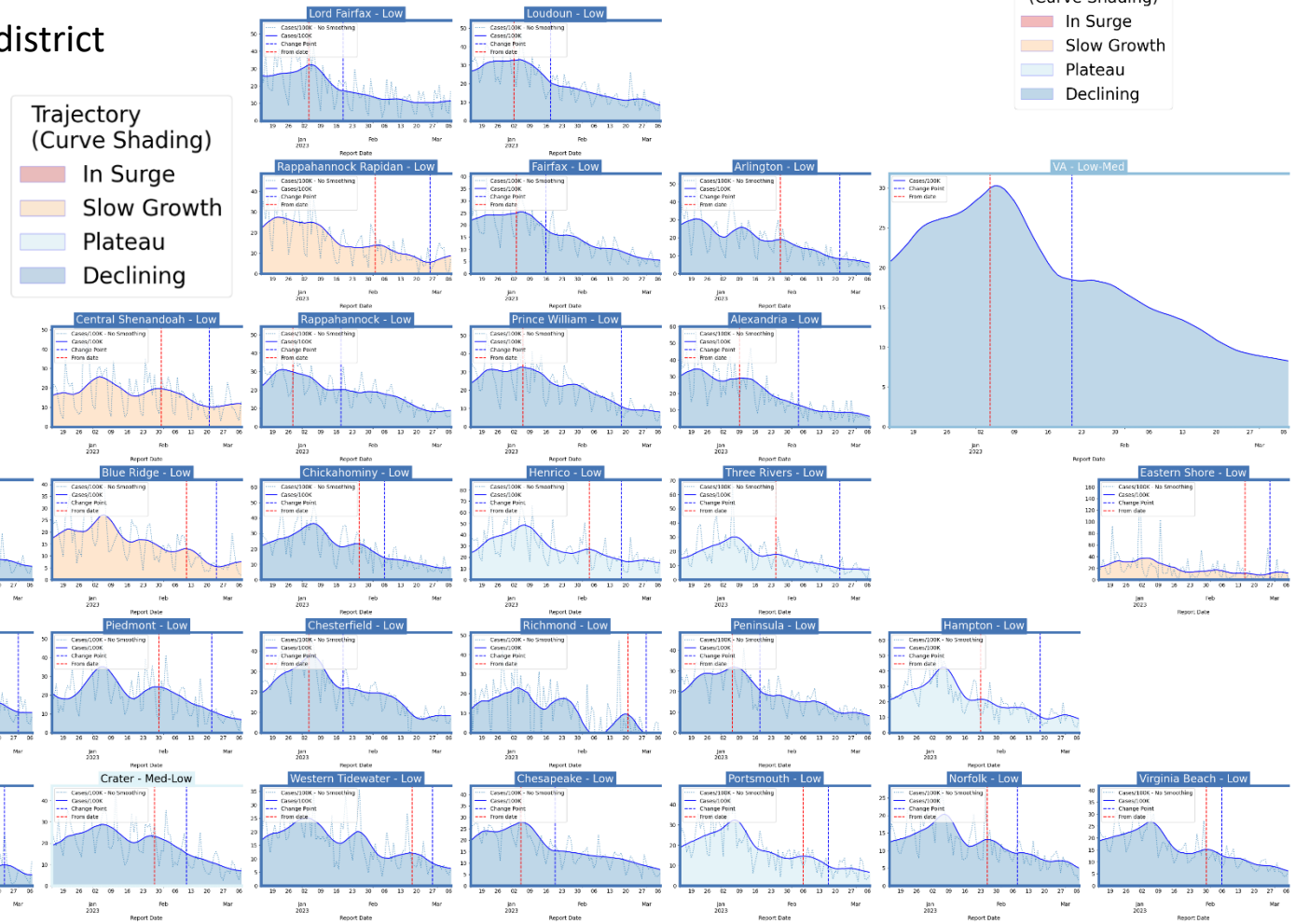
Curve shows smoothed case rate (per 100K)
CDC's new Community Level aggregated to district level in label & chart box color
Case Rate curve colored by Trajectory



District's Aggregate Community Level
Aggregate level a simple mean of all levels for counties in district

Case rate Trajectory

Trajectory (Curve Shading)
- In Surge
- Slow Growth
- Plateau
- Declining



Trajectory (Curve Shading)
- In Surge
- Slow Growth
- Plateau
- Declining

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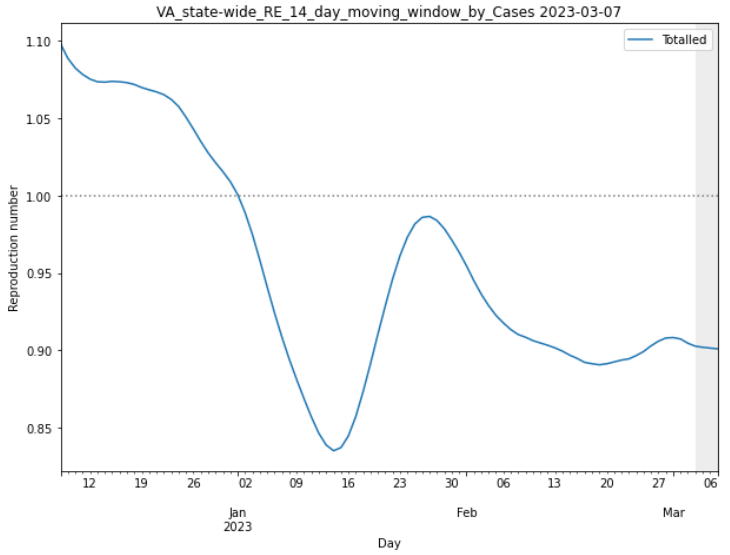
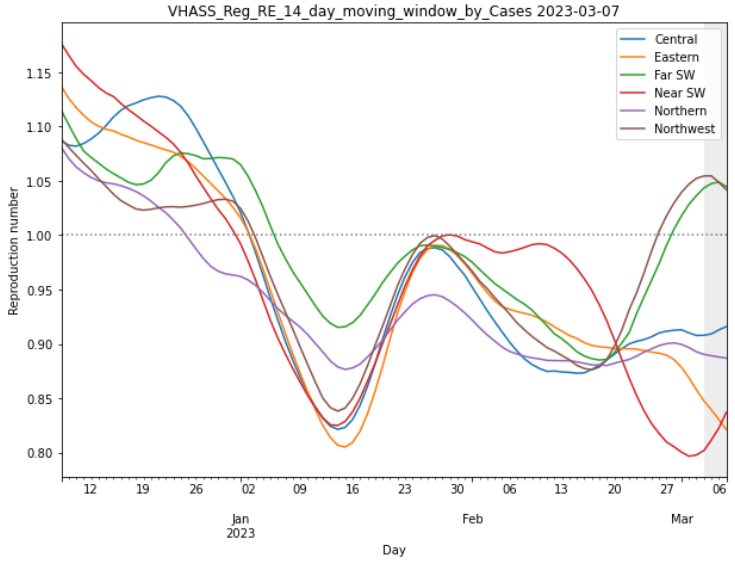
COVID-19 Growth Metrics

Estimating Daily Reproductive Number –
Hospital Admissions Based

March 7th Estimates

Region	Date Confirmed R_e	Date Confirmed Diff Last Week
State-wide	0.901	0.028
Central	0.916	0.043
Eastern	0.821	-0.151
Far SW	1.045	0.182
Near SW	0.837	0.135
Northern	0.887	-0.021
Northwest	1.042	0.106





Methodology

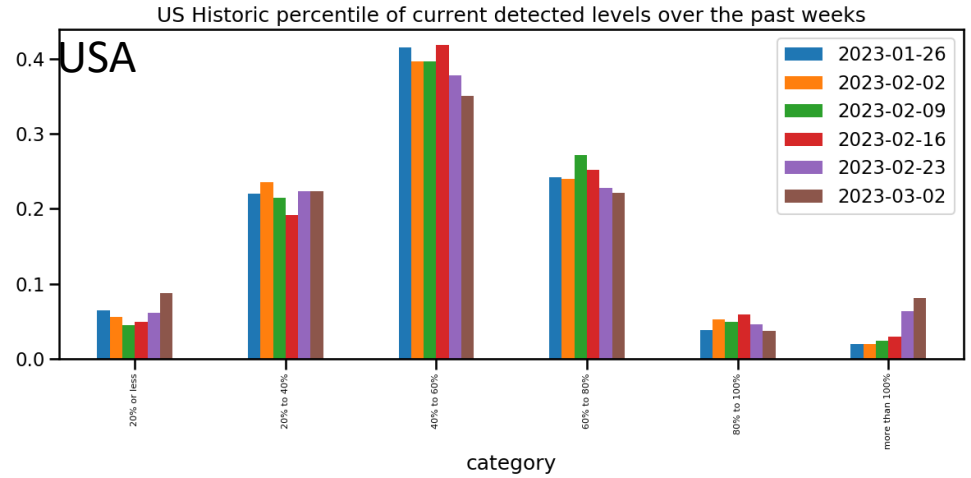
- Wallinga-Teunis method (EpiEstim[1]) for cases by **confirmation date**
- Serial interval: updated to discrete distribution from observations (mean=4.3, Flaxman et al, Nature 2020)
- Using Confirmation date since due to increasingly unstable estimates from onset date due to backfill

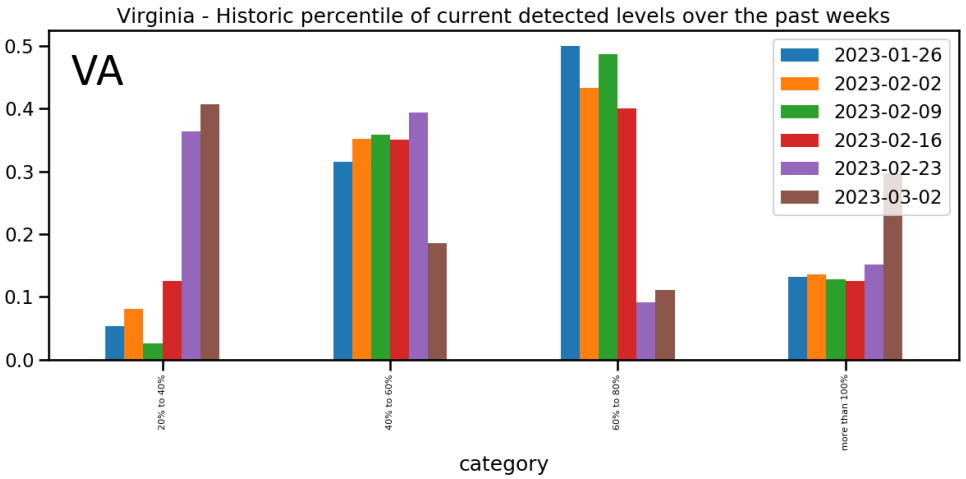
1. Anne Cori, Neil M. Ferguson, Christophe Fraser, Simon Cauchemez. A New Framework and Software to Estimate Time-Varying Reproduction Numbers During Epidemics. American Journal of Epidemiology, Volume 178, Issue 9, 1 November 2013, Pages 1505–1512, https://doi.org/10.1093/aje/kwt133

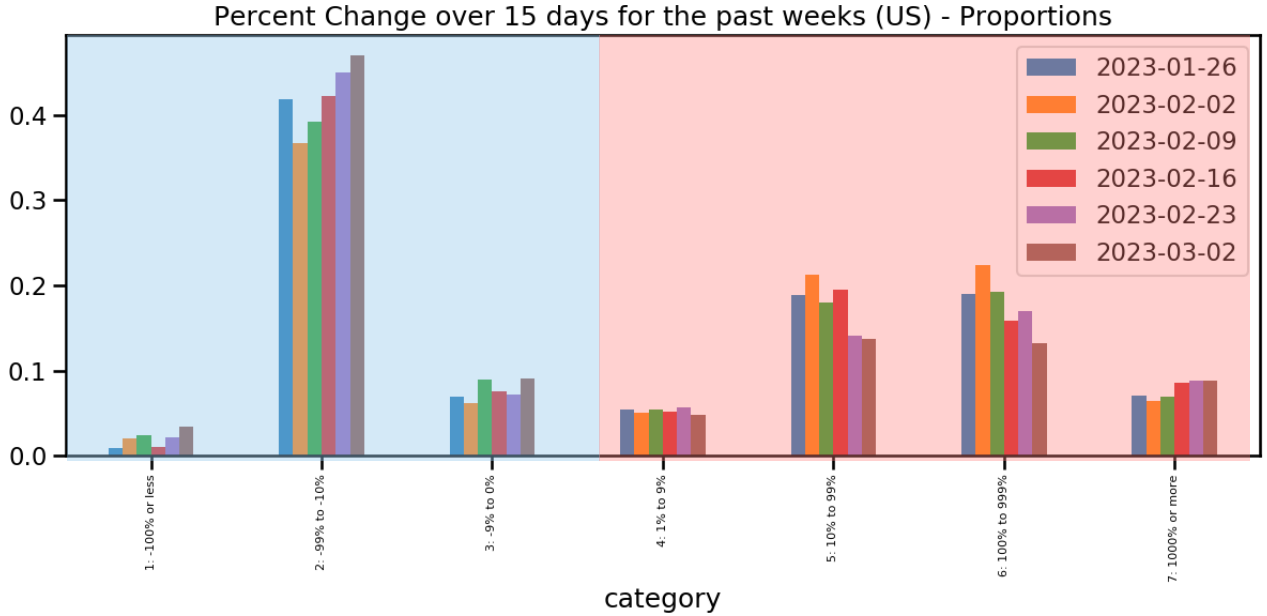
Wastewater Monitoring

Wastewater provides a coarse early warning of COVID-19 levels in communities

- Overall, in the US, there is an increase in sites with increased levels of virus compared to 15 days ago
- Growth seen in the category where current virus levels are at or exceeding max of previous historical levels





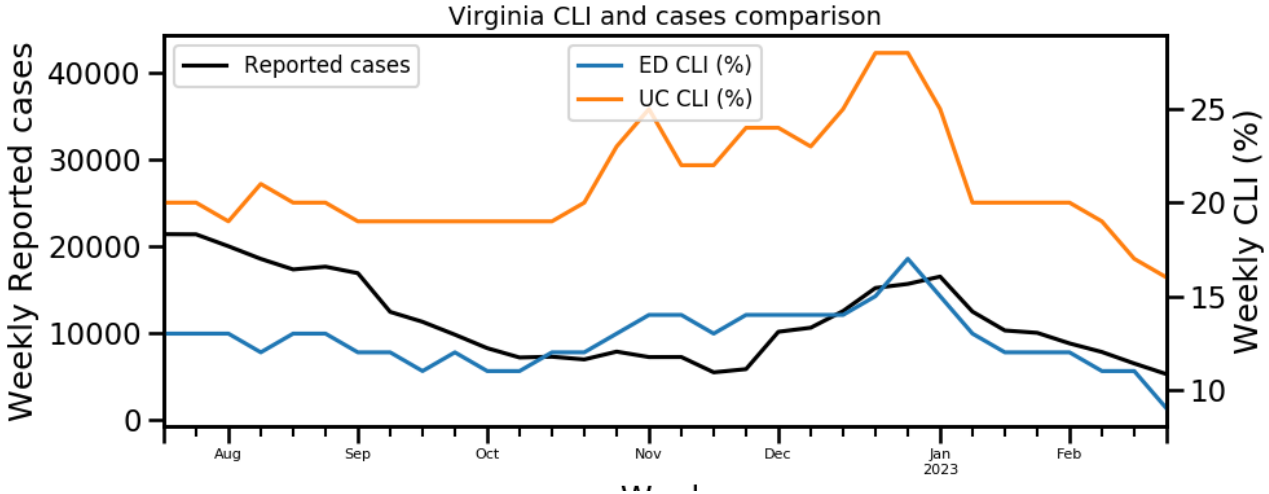


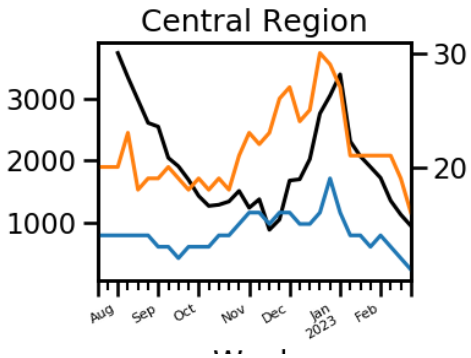
Data Source: [CDC Data Tracker]

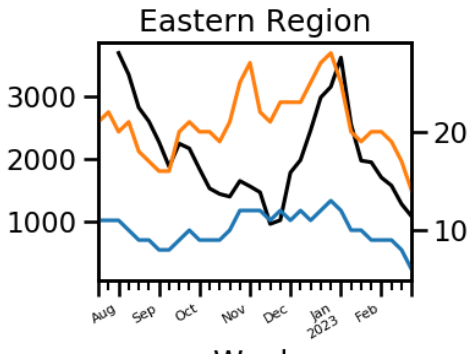
COVID-like Illness Activity

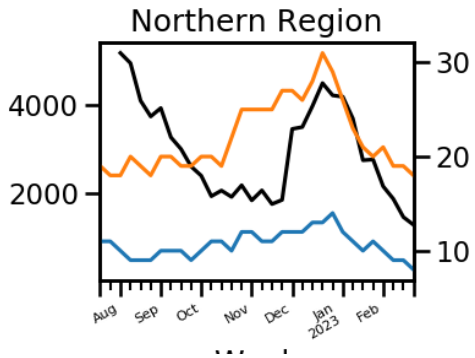
COVID-like Illness (CLI) gives a measure of COVID transmission in the community

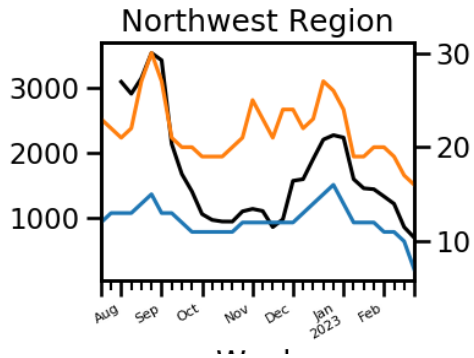
- Emergency Dept (ED) based CLI is more correlated with case reporting
- Urgent Care (UC) is a leading indicator but may be influenced by testing for other URIs
- **UC CLI declining statewide with current levels lower than that observed since Aug 2022**

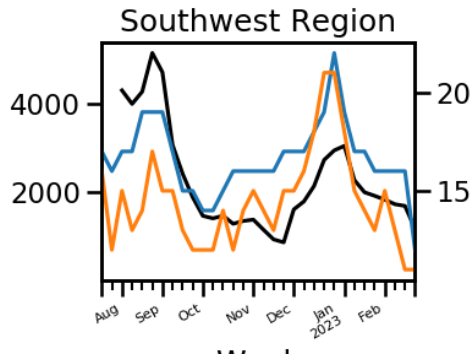












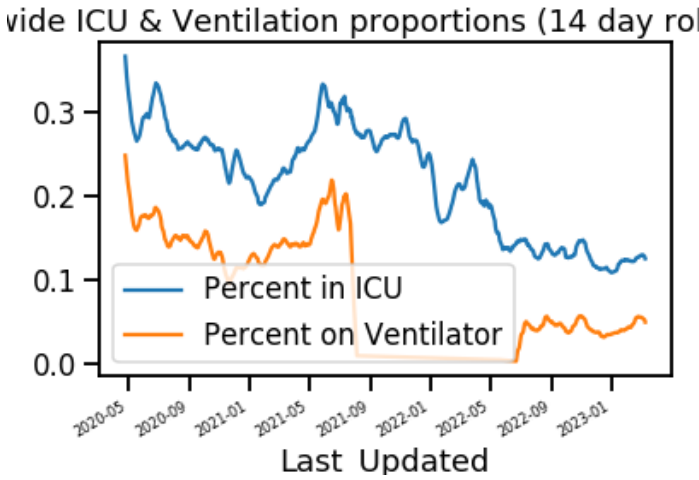
COVID-19 Severity Metrics

Hospitalizations and Severe Outcomes

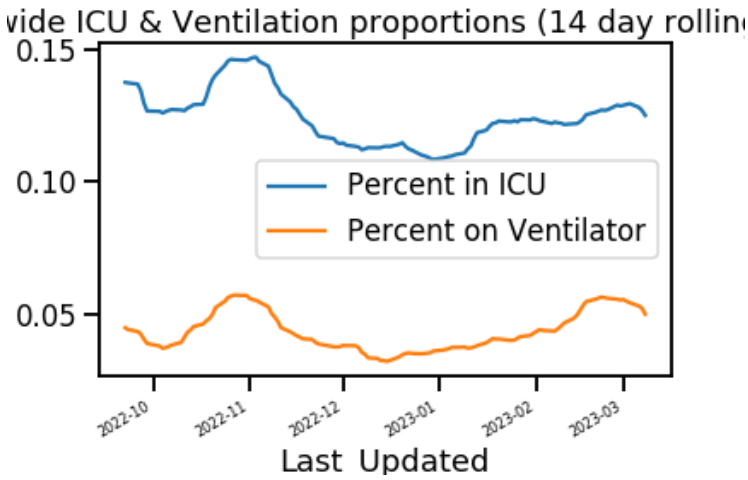
Proportion of most severe outcomes decreasing among those who are hospitalized

- ICU has declined from ~20% of hospitalized to 10-15% since initial Omicron wave
- Recent trend up continues, with nearly reaching late-summer levels now
- Regional variation tracks state-level

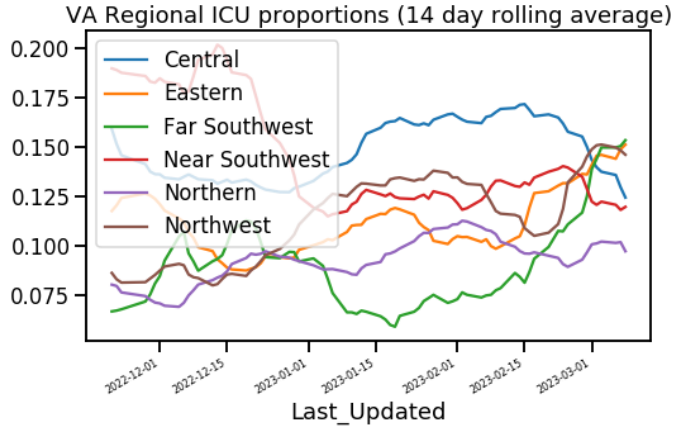
Virginia-wide – full pandemic



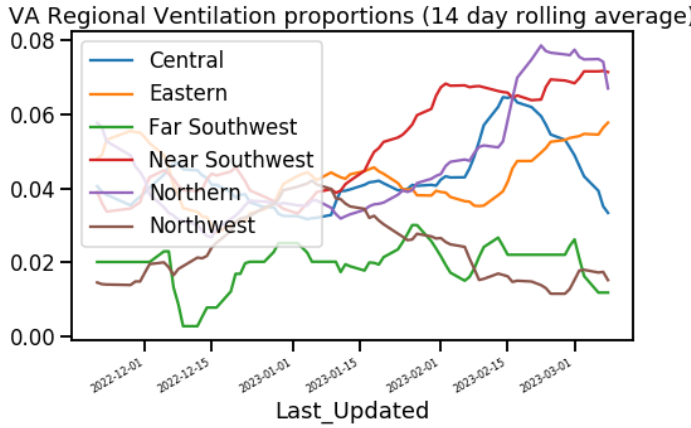
Virginia-wide – recent



Virginia Regional ICU percent



Virginia Regional Ventilation %



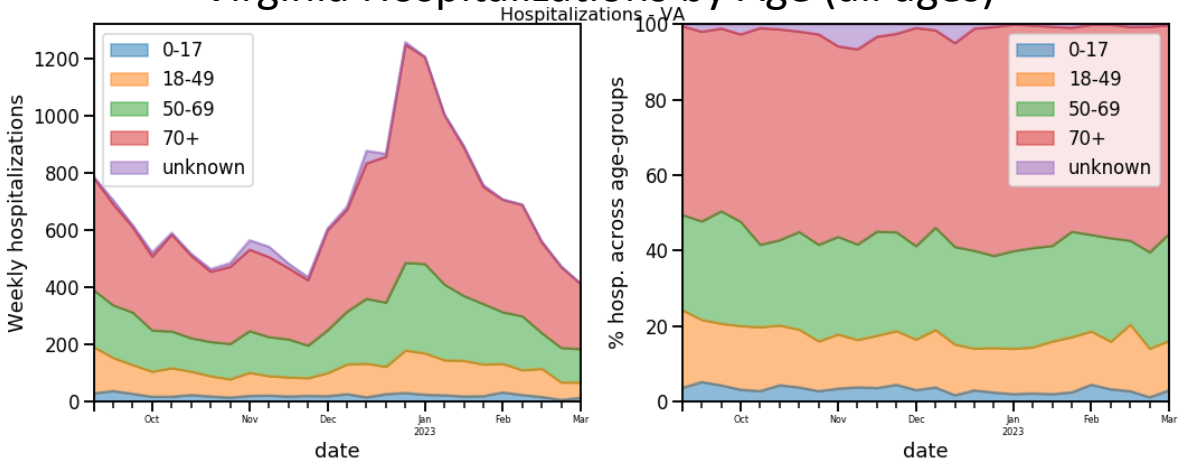
Hospitalizations in VA by Age

Age distribution in hospitals relatively stable

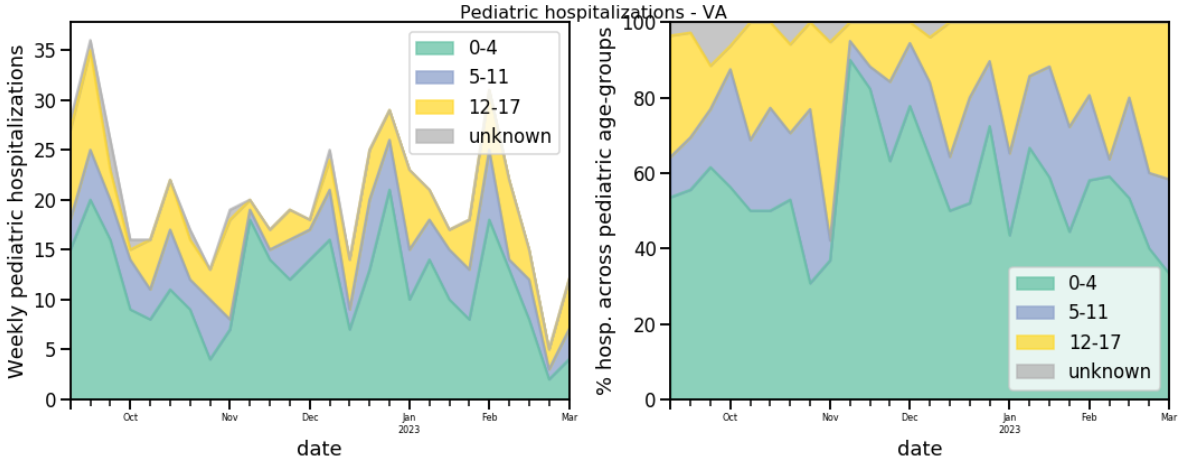
- Overall hospitalizations declining across all age groups – especially in the 70+ age group
- Pediatric hospitalizations have been low but have increased in last week

Note: These data are lagged and based on HHS hospital reporting

Virginia Hospitalizations by Age (all ages)



Pediatric Hospitalizations by Age (0-17yo)



Data Source: Delphi and HHS

Questions?

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